For each statement below, mark the box "correct" if you agree with the statement or the box "incorrect" otherwise.

☐ correct ☐ incorrect CG (conjugate gradient method) is an efficient and optimal iterative method for solving linear systems with symmetric positive definite matrices.

☐ correct ☐ incorrect The eigenvalues of a Hermitian matrix are purely imaginary complex numbers (i.e., they lie on imaginary axis in the complex plane).

☐ correct ☐ incorrect The backward Euler method (also known as the implicit Euler method) is a time integration scheme which, at each time step, requires a solution of a generally nonlinear system of equations.

☐ correct ☐ incorrect The symmetric successive overrelaxation (SSOR) preconditioner is obtained by computing the LU factorization of the system matrix while neglecting the newly introduced fill in.

☐ correct ☐ incorrect Sylvester equations (find X from $AX - XB = C$) can not be reformulated as an equivalent linear system in $x = \mathsf{vec}(X)$.

☐ correct ☐ incorrect The Gram-Schmidt orthogonalization process can be seen as an algorithm for computing the QR factorization.

☐ correct ☐ incorrect Assume that a 700×10 matrix B has only 8 positive singular values. The dimension of the null-space of B can be at most 3.

☐ correct ☐ incorrect Cholesky factorization is a form of QR factorization which is intended for symmetric positive definite matrices.

☐ correct ☐ incorrect The LU factorization method for solving linear systems can be computationally very expensive if the system size is large and the system matrix is sparse. This is because the L and U factors of the factorization can easily lose the sparsity of the original matrix.

☐ correct ☐ incorrect Any Hermitian positive definite matrix has a Cholesky factorization.

☐ correct ☐ incorrect It is necessary for convergence of the Newton method that the Jacobian linear system is solved at each Newton iteration very accurately.

☐ correct ☐ incorrect The inexact Newton method is the Newton method in which the Jacobian linear system is solved at each Newton iteration approximately.

☐ correct ☐ incorrect Newton-Krylov methods are inexact Newton methods in which the Jacobian linear system is solved by a Krylov subspace iterative method.

☐ correct ☐ incorrect Preconditioning is applied to improve convergence of an iterative method. This improvement is often achieved due to eigenvalue clustering in the preconditioned matrix.

☐ correct ☐ incorrect It is impossible to design an iterative method which would be (i) equivalent in exact arithmetic to GMRES, (ii) efficient, (iii) applicable to linear systems with non-Hermitian matrices.

☐ correct ☐ incorrect When applied to a linear system with a Hermitian matrix, the GMRES and MINRES iterative methods are mathematically (i.e. up to the rounding errors) equivalent.

☐ correct ☐ incorrect In general, it is advisable to use GMRES for solving linear systems with symmetric matrices.

☐ correct ☐ incorrect Applying a third-order Runge-Kutta scheme with a time step size τ, we can not expect that the global error will behave as $O(\tau^3)$.

☐ correct ☐ incorrect Implicit trapezoidal rule is an A-stable Runge-Kutta method.

☐ correct ☐ incorrect To apply a Krylov iterative method for solving a linear system, we do not have to know the matrix of the system explicitly, it is sufficient to be able to compute the matrix-vector products with this matrix.